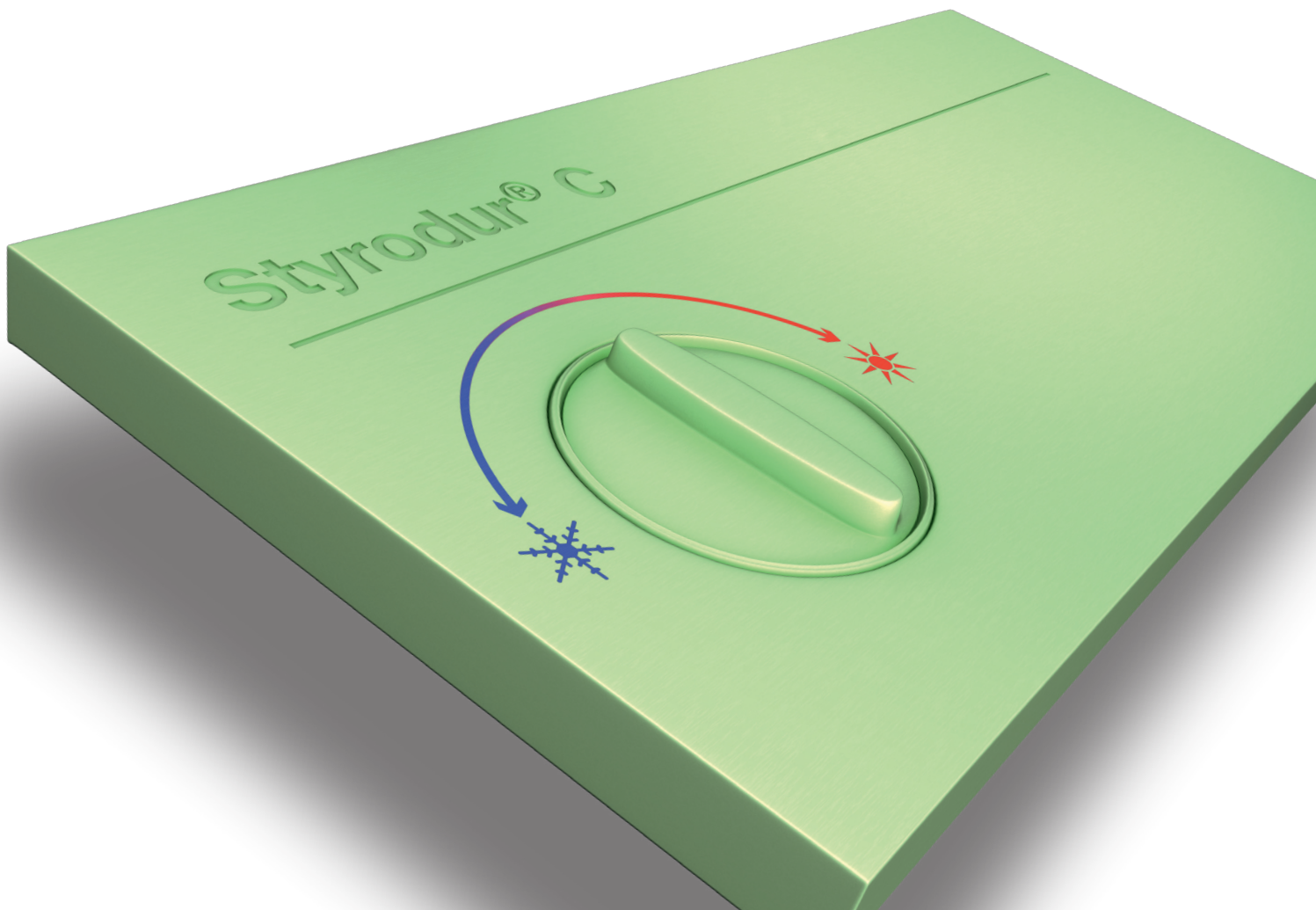


Technical Data and Assistance Data for Dimensioning



5. Recommended Applications Styrodur® C

	Code according to DIN V 4108-10	General	Product properties according to German standards DIN EN 13164 and DIN V 4108-10					
			Styrodur® C					
			2500 C	2800 C	3035 CS	3035 CN	4000 CS	5000 CS
Permit from building authorities	CS(10\Y) 300	CS(10\Y) 300	CS(10\Y) 300	CS(10\Y) 300	CS(10\Y) 500	CS(10\Y) 700		
Perimeter ¹⁾ floor slabs	DIBt Z-23.5-223, PB	wd			dh		ds	dx
Perimeter ¹⁾ basement walls	DIBt Z-23.5-223, PW	wd			dh		ds	dx
Perimeter ¹⁾ load-bearing floor slabs	DIBt Z-23.34-1325 PB	wd			dh		ds	dx
Perimeter ¹⁾ /subsoil water areas	DIBt Z-23.5-223 PW, PB	wd			dh		ds	dx
Domestic floor	DEO		dm	dm	dh			
Industrial and refrigerated warehouse floors	DEO		dm	dm	dh		ds	dx

Cavity walls	WZ	tf	dm		dh	dm		
Internal walls	WI	tf		dm				
Lost formwork	WAP	tf		dm				
Cold bridges	WAP	tf		dm				
Exterior basement wall insulation	WAP	wf		dm				
Plaster base	WAP	wf		dm				

Inverted flat roofs	DUK	wd			dh		ds	dx
Duo roofs/Plus roofs	DUK	wd			dh		ds	dx
Promenade roofs	DUK	wd			dh		ds	dx
Roof gardens	DIBt Z-23.4-222 DUK	wd			dh		ds	dx
Parking decks	DUK	wd					ds ²⁾	dx
Conventional flat roofs ³⁾	DAA	wf	dm		dh		ds	dx
Parapet walls	DAA	wf	dm	dm	dh			
Basement ceiling/Underground garage ceiling	DI	tf		dm				
Attic ceiling	-	tf			dh			
Pitched roofs	DAD	wf	dm	dm		dm		
Ceilings	DI	tf	dm			dm		

Drywall composite board	WI	tf		dm				
Sandwich panels	-	tf	dm	dm				
Warehouses	DI, WI, DEO	tf	dm		dh	dm	ds	dx
Ice rinks	PB	wd			dh		ds	dx
Road transport infrastructure/Rail construction	PB	wd			dh		ds	dx

Styrodur® C: Product approval: DIBt Z-23.15-1481, extruded polystyrene foam in accordance with DIN EN 13164; Free of HCFC and HFC

¹⁾ = Insulation in direct contact with the ground

²⁾ = Not for installation under concrete paving stones

³⁾ = With protective layer over the sealing

dm = 200 kPa, dh = 300 kPa, ds = 500 kPa, dx = 700 kPa

Note:

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out their own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights, etc. given herein may be changed without prior notice and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed. (September 2011)

2.4 Allowable Mounting Depth

Assistance data for dimensioning of Styrodur® C applications in basements

Allowable mounting depth

Calculations for soil pressure with silt sand

Application	Mounting depth in m for Styrodur® C grades				
	2500 C	2800 C	3035 CS	4000 CS	5000 CS
Without ground water pressure DIN 4108-10	Not standardized	Not standardized	9	17	24
With ground water pressure	Not allowable	Not allowable	3.5	3.5	3.5

Note for other materials:

EPS:

- Maximum mounting depth: 3 or 6 m
- Minimum distance of traffic loads: 3 m
- Not allowable in case of water pressure
- ΔU of 0.05 W/(m²·K) must be added to take into account water absorption

Cellular glass:

Maximum mounting depth with water pressure: 12 m

2.5 Absence of Condensation Water

Assistance data for dimensioning of Styrodur C applications in cold bridges and basement insulation

Absence of condensation water in the plinth area

Calculations for:

- Internal surface resistance $R_i = 0.13 \text{ m}^2\cdot\text{K}/\text{W}$
- 200 mm concrete wall
- External surface resistance $R_a = 0.04 \text{ m}^2\cdot\text{K}/\text{W}$
- Interior room air temperature: 20°C

Relative humidity in %	Required minimum U value in W/(m ² ·K) at exterior air temperature of	
	-10°C	-15°C
50	2.1	1.8
60	1.5	1.3
70	1.1	0.9
80	0.7	0.6
90	0.33	0.29

1. Mechanical Characteristic Values (Mean Value, Reference Value)

1.1 Load-bearing Applications

Technical data for load-bearing applications of Styrodur® C							
Properties of Styrodur® C	Unit	2500 C	2800 C	3035 CS	4000 CS	5000 CS	Standard
Compressive strength or compressive stress (at 10% deformation)	kPa	200	200	300	500	700	EN 826
Allowable mid-term compressive creep (deformation < 2%, 1000h)	kPa	100	100	160	240	300	ISO 7850
Allowable long-term compressive creep (compression < 2%, 50 years)	kPa	80	80	130	180	250	EN 1606
Modulus of elasticity	kPa	15,000	20,000	20,000	30,000	40,000	EN 826
Long-term modulus of elasticity	kPa	–	–	5,000	10,000	14,000	EN 1606

1.2 Strength

Strength							
Eigenschaften Styrodur® C	Unit	2500 C	2800 C	3035 CS	4000 CS	5000 CS	Standard
Compressive strength or compressive stress (at 10% deformation)	kPa	200	200	300	500	700	EN 826
Bending strength	kPa	500	500	500	500	500	EN 12089
Tensile strength	kPa	150	150	300	400	500	EN 1607
Shear strength	kPa	200	200	300	300	300	EN 12090

1.3 Dynamic Stiffness

Dynamic stiffness of Styrodur® grades 3035 CS, 4000 CS and 5000 CS											
Board thickness	mm	30	40	60	80	100	120	140	160	180	200
Styrodur® 3035 CS	MN/m³	500	380	260	190	150	130	100	80	60	50
Styrodur® 4000 CS	MN/m³	550	400	280	210	170	150	120	100	80	70
Styrodur® 5000 CS	MN/m³	600	420	300	230	190	170	140	120	100	90

2. Assistance Data for Dimensioning

2.1 Traffic Load

Traffic load											
Vehicle ¹⁾				Compressive stress at traffic load in kPa							
				Nonreinforced layered construction ²⁾ thickness of layer above insulation in mm				Reinforced concrete static height in mm			
Type	Weight	Wheel load	Contact area	180	200	220	240	90	100	110	120
	in metric tons	in kN	in mm x mm								
Heavy truck	30	50	200 x 400	200	180	170	140	230	200	190	180
Truck	16	50	200 x 400	200	180	170	140	230	200	190	180
Truck	12	40	200 x 300	190	170	160	150	220	200	180	170
Truck	9	30	200 x 260	160	140	130	120	180	160	150	140
Truck	6	20	200 x 200	120	110	100	90	140	130	100	100
Truck	3	10	200 x 160	60	50	50	40	70	60	60	50
Truck	< 3	10	200 x 200	60	50	50	40	60	60	60	50
Forklift	7	32.5	200 x 200	200	170	160	140	220	200	180	170
Forklift	3.5	15	200 x 200	90	80	70	60	100	90	80	80
Forklift	2.5	10	200 x 200	60	50	50	40	70	60	60	50

¹⁾ Heavy truck, truck, and car according to DIN 1072; forklift according to DIN 1055.

²⁾ **Important note:** For reasons of long-term positional stability, the deformation under compressive stress caused by traffic loads must not exceed 0.7 mm*); this is why Styrodur® 5000 CS must always be used with concrete paving stones in parking roof structures, even under compressive stress values that would allow the use of Styrodur 3035 CS or Styrodur 4000 CS.

*) According to the information sheet on surface reinforcement with pavement and slabstone paving issued by the German Road and Transportation Research Association, Cologne/Germany, 1994.

Styrodur® C grade	Dimensioning of Styrodur® C grade				
	2500 C	2800 C	3035 CS	4000 CS	5000 CS
Allowable long-term compressive traffic load in kPa	80	80	130	230	300

2.2 Floor Slabs

Assistance data for dimensioning of Styrodur® C applications under floor slabs																
Styrodur® C grade	Long-term bedding modulus in N/mm ³ for board thicknesses in mm															
	30	40	50	60	80	100	120	140	160	180	200	220	240	260	280	300
3035 CS	0.167	0.125	0.100	0.083	0.063	0.050	0.042	0.036	0.031	0.028	0.025	0.023	0.021	0.019	0.018	0.017
4000 CS	0.333	0.250	0.200	0.167	0.125	0.100	0.083	0.071	0.063	0.056	0.050	0.045	0.042	0.038	0.036	0.033
5000 CS	0.467	0.350	0.280	0.233	0.175	0.140	0.117	0.100	0.088	0.078	0.070	0.064	0.058	0.054	0.050	0.047

Modulus of subgrade reaction = modulus of long-term compressive elasticity / thickness of insulating layer

2.3 Basements

Assistance data for dimensioning of Styrodur® C applications in basements

The calculations consider the heat transmission resistance $R_i = 0.13 \text{ m}^2\text{-K/W}$ und $R_a = 0.0 \text{ m}^2\text{-K/W}$ (against ground).

Insulation layer thickness [mm]	U value in $\text{W}/(\text{m}^2\text{-K})$ for different thicknesses of insulation layer for thermal conductivity of insulation layer								
	0.028	0.030	0.032	0.034	0.036	0.038	0.040	0.042	0.044
30	0.83	0.88	0.94	0.99	1.04	1.09	1.14	1.18	1.23
40	0.64	0.68	0.72	0.77	0.81	0.85	0.88	0.92	0.96
50	0.52	0.56	0.59	0.62	0.66	0.69	0.72	0.76	0.79
60	0.44	0.47	0.50	0.53	0.56	0.59	0.61	0.64	0.67
70	0.38	0.41	0.43	0.46	0.48	0.51	0.53	0.56	0.58
75	0.36	0.38	0.40	0.43	0.45	0.48	0.50	0.52	0.55
80	0.33	0.36	0.38	0.40	0.43	0.45	0.47	0.49	0.51
90	0.30	0.32	0.34	0.36	0.38	0.40	0.42	0.44	0.46
100	0.27	0.29	0.31	0.33	0.34	0.36	0.38	0.40	0.42
110	0.25	0.26	0.28	0.30	0.31	0.33	0.35	0.36	0.38
120	0.23	0.24	0.26	0.27	0.29	0.30	0.32	0.33	0.35
130	0.21	0.22	0.24	0.25	0.27	0.28	0.30	0.31	0.32
140	0.19	0.21	0.22	0.24	0.25	0.26	0.28	0.29	0.30
150	0.18	0.19	0.21	0.22	0.23	0.25	0.26	0.27	0.28
160	0.17	0.18	0.19	0.21	0.22	0.23	0.24	0.25	0.27
180	0.15	0.16	0.17	0.18	0.19	0.21	0.22	0.23	0.24
200	0.14	0.15	0.16	0.17	0.18	0.19	0.19	0.20	0.21
220	0.13	0.13	0.14	0.15	0.16	0.17	0.18	0.19	0.19
240	0.11	0.12	0.13	0.14	0.15	0.16	0.16	0.17	0.18
260	0.11	0.11	0.12	0.13	0.14	0.14	0.15	0.16	0.17
280	0.10	0.11	0.11	0.12	0.13	0.13	0.14	0.15	0.15
300	0.09	0.10	0.11	0.11	0.12	0.12	0.13	0.14	0.14
Target U value in $\text{W}/(\text{m}^2\text{-K})$	Theoretical thickness of insulation layer in mm for thermal conductivity of insulation layer								
	0.028	0.030	0.032	0.034	0.036	0.038	0.040	0.042	0.044
0,80	32	34	36	39	41	43	45	48	50
0,70	37	39	42	45	47	50	52	55	58
0,60	44	47	50	53	56	59	62	65	68
0,50	53	57	60	64	68	72	75	79	83
0,40	67	72	76	81	86	91	95	100	105
0,35	77	82	88	93	99	104	110	115	120
0,30	90	97	103	109	116	122	129	135	141
0,25	109	117	124	132	140	148	155	163	171
0,22	124	133	142	151	159	168	177	186	195
0,21	130	139	149	158	167	177	186	195	204
0,20	137	147	156	166	176	186	195	205	215
0,18	152	163	174	185	196	207	218	228	239
0,15	184	197	210	223	236	249	262	275	288
0,12	230	247	263	279	296	312	329	345	361
0,10	277	297	316	336	356	376	395	415	435

1.	Mechanical Characteristic Values (Mean Value, Reference Value)	
1.1	Load-bearing Applications	3
1.2	Strength	3
1.3	Dynamic Stiffness	3
2.	Assistance Data for Dimensioning	
2.1	Traffic Load	4
2.2	Floor Slabs/Modulus of subgrade reaction	4
2.3	Basements	5
2.4	Allowable Mounting Depth	6
2.5	Absence of Condensation Water	6
3.	Thermal Conductivity	
3.1	Thickness Dependence	7
3.2	Temperature Dependence	7
3.3	Moisture Dependence	7
4.	Adhesiveness and Bond Strength	
4.1	Adhesive Properties	8
4.2	Which Glue Is Suited for Which Surface Material?	8
5.	Recommended Applications	9

3. Thermal Conductivity

3.1 Thickness Dependence

Wärmeleitfähigkeit (Richtwerte) von Styrodur® C

As of 2011

Board thickness in mm	Declared thermal conductivity λ_D in W/(m·K) according to EN 13164	Calculation value of thermal conductivity λ according to DIN 4108-4 for standardized applications in W/(m·K)	Declared thermal resistance R_D according to EN 13164 in m ² ·K/W
20	0.032	0.033	0.65
30	0.032	0.033	0.95
40	0.034	0.035	1.20
50	0.034	0.035	1.50
60	0.035	0.036	1.75
70	0.036	0.037	1.90
80	0.036	0.037	2.25
90	0.038	0.039	2.40
100	0.038	0.039	2.65
120	0.038	0.039	3.20
140	0.040	0.041	3.40
160	0.042	0.043	3.90
180	0.042	0.043	4.25
200	0.044	0.045	4.50

3.2 Temperature Dependence

Thermal conductivity of Styrodur C (reference values)

Example: Styrodur 3035 CS, thickness 60mm

Temperature [°C]	Thermal conductivity in W/(m·K) Styrodur® C
-80	0.026
-60	0.029
-40	0.030
-20	0.032
0	0.034
10	0.035
20	0.036
30	0.037
40	0.038
50	0.039

3.3 Moisture Dependence

Thermal conductivity of Styrodur C (reference values)

Between 0–12% by volume of moisture content, thermal conductivity increases 2.3% per 1% by volume

Moisture content [% by vol.]	Thermal conductivity in W/(m·K) Styrodur® C
0	0.035
1	0.036
2	0.036
3	0.037
4	0.037
5	0.038
6	0.039
8	0.040
10	0.041
12	0.042

3.4 Approved applications

Rated values of thermal conductivity in W/(m·K) as per DIBt approval (German Institute for Building Technology) As of 2011

Approved Styrodur® types: 3035 CS, 4000 CS, and 5000 CS

Board thickness in mm	Thermal insulation under foundation slab load-bearing DIBt Z-23.34-1325		Perimeter insulation of walls with ground contact and basement floors (non-load-bearing building elements) DIBt Z-23.5-223				Inverted roof constructions DIBt Z-23.4-222			
	Ground moisture	Pressing water	Wall area	under basement floors	Installation in pressing water and accumulating seepage water		Green roof	Frequent-ed	With gravel layer and water-draining separation layer	
					single-layer ²⁾	multilayer ²⁾			Single-layer	Double-layer
≤ 60	0.035	0.037	0.040	0.035	0.037	0.040	0.037	0.037	0.035	–
≤ 80	0.037	0.039	0.042	0.037	0.039	0.042	0.039	0.039	0.037	–
≤ 120	0.039	0.041	0.044	0.039	0.041	0.044	0.040	0.040	0.039	0.042
≤ 160	0.039	0.041	0.044	0.039	0.041	0.044	0.040	0.040	0.039	0.042
≤ 200	0.041	0.043	0.046	0.041	0.043	0.046	0.042	0.042	0.041	0.044

¹⁾ Application for ground moisture and nonaccumulating seepage water in accordance DIBt Z-23.5-223 Table 5 and Section 4.1 and 4.2

²⁾ Application in accordance with DIBt Z-23.5-223 Table 5 and Section 4.1 and 4.3

4. Adhesiveness and Bond Strength

4.1 Adhesive Properties

Adhesiveness and bond strength for different gluing agents in Styrodur® C applications
Mean values, reference values

Properties Styrodur® C	Unit	2800 C	2500 C, 3035 CS, 4000 CS, 5000 CS
Surface	–	Rough (stamped thermally)	Smooth (foamed skin)
Adhesive strength on concrete	kPa	200–400	< 100
Adhesive strength on mineralic surfaces (brick, pumice stone, etc.)	kPa	150–300	< 100
Adhesive strength on gluing mortar ^{1), 2), 3)}	kPa	150–300	< 100
Adhesive strength on plasters	kPa	100–200	< 100
Adhesive strength on metals ⁴⁾	kPa	> 300	> 200
Adhesive strength on wood ⁴⁾	kPa	> 300	> 200
Adhesive strength on plastics ⁴⁾	kPa	> 300	> 200

¹⁾ Dispersion content leads to higher adhesive strengths.

²⁾ Higher adhesive strengths may be achieved by applying a thin contact-mortar layer on the gluing surface.

³⁾ Values only apply to branded articles.

⁴⁾ These values are for full-surface gluing.

4.2 Which Glue Is Suited for Which Surface Material?

	Mineral surface	Mortar	Metal	Wood	Plastics
Gluing mortar	■	■			
Epoxy resin glue			■	■	■
PUR glue			■	■	■

Important note:

The dimensioning aids are noncommittal planning aids.

They do not replace the technical and structural design of an engineering specialist.

Styrodur® C—A Strong Product Line

With the Styrodur® C product line, BASF offers the ideal insulation solution for almost every application.

Styrodur 2500 C

- The light thermal insulation board with smooth surface and smooth edges for applications with normal compressive strength requirements.

Styrodur 2800 C

- The thermal insulation board with embossed honeycomb pattern and smooth edges for application in combination with concrete, plaster, and other covering layers.



Styrodur 3035 CS

- The all-round thermal insulation board with smooth surface and overlap is suitable for almost all applications in structural and civil engineering.

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- The long thermal insulation board with smooth surface and groove and tongue for quick, thermal bridge-free installation.

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- The light green, high temperature-resistant thermal insulation board for all areas of application with thermal loads of up to 105 °C. Further information: www.styrodur.com

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